their serviceability. Moisture proof coatings shall be applied uniformly and shall be free from pinholes or other visible defects which would impair their usefulness.

(c) *Construction.* The casing shall be fitted and secured to the handle with not less than a 25 mm (1 in.) overlap and shall be attached to the handle in such a manner that failure of the joint will not occur during tests, ignition, or operation. The plug shall be securely affixed in the casing to separate the smoke composition from the wooden handle. The smoke composition shall be thoroughly mixed and be uniformly compresssed throughout to preclude variations of density which may adversely affect uniformity of its smoke emitting characteristics. The cap shall have a lap fit of not less than 25 mm (1 in.) over the end of the casing and smoke composition to entirely and securely protect the exposed surface of the igniter button and end of smoke composition and casing, and shall have an inner shoulder so constructed that it is mechanically impossible for the inner surface of the cap to come in contact with the igniter button. The cap shall be securely attached to the casing in such manner as to preclude its accidental detachment. The cap shall be provided on its top with a friction striking material which shall, by a pull of the tear strip, be entirely exposed for striking the friction igniter button. The igniter button shall be non-water soluble or be protected from moisture by a coating of some waterproof substance, and shall be raised or exposed in such manner as to provide positive ignition by the friction striker. The igniter button shall be firmly secured in or on the top of the smoke composition; the arrangement shall be such that the ignition will be transmitted to the smoke producing composition. The assembled signal, consisting of tear strip, cap, casing, and handle, shall be sealed and treated to protect the signal from deterioration by moisture. The protective waterproof coating shall be applied so none adheres to the friction striking surface. Special consideration will be given to alternate waterproofing of the signal by means of a water-resistant coating on the signal plus packaging in a sealed plastic waterproof bag satisfactory to the Commandant.

(d) *Performance.* Signals shall meet all the inspection and test requirements contained in § 160.037–4.

§ 160.037–4 Approval and production tests.

(a) *Approval tests.* The manufacturer must produce a lot of at least 100 signals from which samples must be taken for testing for approval under § 160.037–7. The approval tests are the operational tests and technical tests in paragraphs (c) and (d) of this section. The approval tests must be conducted by an independent laboratory accepted by the Commandant under § 159.010 of this chapter.

(b) *Production inspections and tests.* Production inspections and tests of each lot of signals produced must be conducted under the procedures in § 159.007 of this chapter. Signals from a rejected lot must not be represented as meeting this subpart or as being approved by the Coast Guard. If the manufacturer identifies the cause of the rejection of a lot of signals, the signals in the lot may be reworked by the manufacturer to correct the problem. Samples from the rejected lot must be retested in order to be accepted. Records shall be kept of the reasons for rejection, the reworking performed on the rejected lot, and the results of the second test.

(1) *Lot size.* For the purposes of sampling the production of signals, a lot must consist of not more than 30,000 signals. Lots must be numbered serially by the manufacturer. A new lot must be started with:

(i) Any change in construction details,

(ii) Any change in sources of raw materials, or

(iii) The start of production on a new production line or on a previously discontinued production line.

(2) *Inspections and tests by the manufacturer.* The manufacturer's quality control procedures must include inspection of materials entering into construction of the signals and inspection of the finished signals, to determine that signals are being produced in accordance with the approved plans. Samples from each lot must be tested

in accordance with the operational tests in paragraph (c) of this section.

(3) *Inspections and tests by an independent laboratory.* An independent laboratory accepted by the Commandant under § 159.010 of this Chapter must perform or supervise the inspections and tests under paragraph (b)(2) of this section at least 4 times a year, unless the number of lots produced in a year is less than four. The inspections and tests must occur at least once during each quarterly period, unless no lots are produced during this period. If less than four lots are produced, the laboratory must perform or supervise the inspection and testing of each lot. In addition, the laboratory must perform or supervise the technical tests in paragraph (d) of this section at least once for every ten lots of signals produced, except that the number of technical tests must be at least one but not more than four per year. If a lot of signals tested by the independent laboratory is rejected, the laboratory must perform or supervise the inspections and tests of the reworked lot and the next lot of signals produced. The tests of each reworked lot and the next lot produced must not be counted for the purpose of meeting the requirement for the annual number of inspections and tests performed or supervised by the independent laboratory.

(c) *Operational tests.* Each lot of signals must be sampled and tested as follows:

(1) *Sampling procedure and accept/reject criteria.* A sample of signals must be selected at random from the lot. The size of the sample must be the individual sample size in Table 160.037–4(c)(1) corresponding to the lot size. Each signal in the sample is tested as prescribed in the test procedure in paragraph (c)(2) of this section. Each signal that has a defect listed in the table of defeats (Table 160.037–4(c)(2)) is assigned a score (failure percent) in accordance with that table. In the case of multiple defects, only the score having the highest numerical value is assigned to that signal. If the sum of all the failure percents (cumulative failure percent) for the number of units in the sample is less than or equal to the accept criterion, the lot is accepted. If the sum is equal to or more than the reject criterion the lot is rejected. If the cumulative failure percent falls between the accept and reject criteria, another sample is selected from the production lot and the operational tests are repeated. The cumulative failure percent of each sample tested is added to that of the previous samples to obtain the cumulative failure percent for all the signals tested (cumulative sample size). Additional samples are tested and the tests repeated until either the accept or reject criterion for the cumulative sample size is met. If any signal in the sample explodes when fired, or ignites in a way that could burn or otherwise injure the person firing it, the lot is rejected without further testing. (This procedure is diagrammed in figure 160.037–4(c)).

(2) *Test procedure.* Each sample signal (specimen) must be tested as follows:

(i) *Conditioning of test specimens—water resistance.* Immerse specimen horizontally with uppermost portion of the signal approximately 25 mm (1 in.) below the surface of the water for a period of 24 hours. If the signal is protected by alternate waterproofing consisting of a water-resistant coating on the signal plus packaging in a sealed plastic waterproof bag, the 24-hour water immersion conditioning will be conducted while the signal is in the sealed plastic waterproof bag and will be followed by an additional immersion of the bare signal (i.e., after removal from the bag) 25 mm (1 in.) below the surface of the water for a period of 10 minutes.

(ii) *Waterproofing of igniter button.* Remove the cap from the test specimen. Place head of specimen without cap about 25 mm (1 in.) under the surface of water for approximately 5 minutes. Remove specimen from the water and wipe dry.

(iii) *Smoke emitting time.* Ignite specimen according to directions printed on the signal. The smoke emitting time of a specimen shall be obtained by stop watch measurements from the time of distinct, sustained smoke emission until it ceases. The watch shall be stopped during periods of flame emission. The smoke emitting time for a specimen shall be not less than 50 seconds.

(iv) *Ignition and smoke emitting characteristics.* Test specimens shall ignite and emit smoke properly when the directions on the signal are followed. Test specimens shall not ignite explosively in a manner that might be dangerous to the user or persons close by. The plug separating the smoke producing composition from the handle shall in no case allow flame or hot gases to pass through it or between it and the casing in such manner as might burn the hand while holding the signal by the handle.

TABLE 160.037–4(C)(1)—ACCEPT AND REJECT CRITERIA FOR OPERATIONAL TEST LOTS

Lot size	Individual sample size	Sample	Cumulative sample size	Accept[1]	Reject[1]
280 or less.	8	First	8	([2])	400
		Second	16	100	500
		Third	24	200	600
		Fourth	32	300	700
		Fifth	40	500	800
		Sixth	48	700	900
		Seventh	56	950	951
281 to 500.	13	First	13	0	400
		Second	26	100	600
		Third	39	300	800
		Fourth	52	500	1,000
		Fifth	65	700	1,100
		Sixth	78	1,000	1,200
		Seventh	91	1,350	1,351
501 to 1,200.	20	First	20	0	500
		Second	40	300	800
		Third	60	600	1,000
		Fourth	80	800	1,300
		Fifth	100	1,100	1,500
		Sixth	120	1,400	1,700
		Seventh	140	1,850	1,851
1,201 to 3,200.	32	First	32	100	700
		Second	64	400	1,000
		Third	96	800	1,300
		Fourth	128	1,200	1,700
		Fifth	160	1,700	2,000
		Sixth	192	2,100	2,300
		Seventh	224	2,550	2,551
More than 3,201.	50	First	50	200	900
		Second	100	700	1,400
		Third	150	1,300	1,900
		Fourth	200	1,900	2,500
		Fifth	250	2,500	2,900
		Sixth	300	3,100	3,300
		Seventh	350	3,750	3,751

[1] Cumulative failure percent.
[2] Lot may not be accepted. Next sample must be tested.

TABLE 160.037–4(C)(2)

Kind of defects	Percentage of failure
a. Failure to ignite	100
b. Ignites or burns dangerously	50
c. Non-uniform smoke-emitting rate	50
d. Smoke-emitting time less than 70 pct of specified time.	100
e. Smoke-emitting time at least 70 pct but less than 80 pct of specified time.	75
f. Smoke-emitting time at least 80 pct but less than 90 pct of specified time.	50
g. Smoke-emitting time at least 90 pct but less than 100 pct of specified time.	25

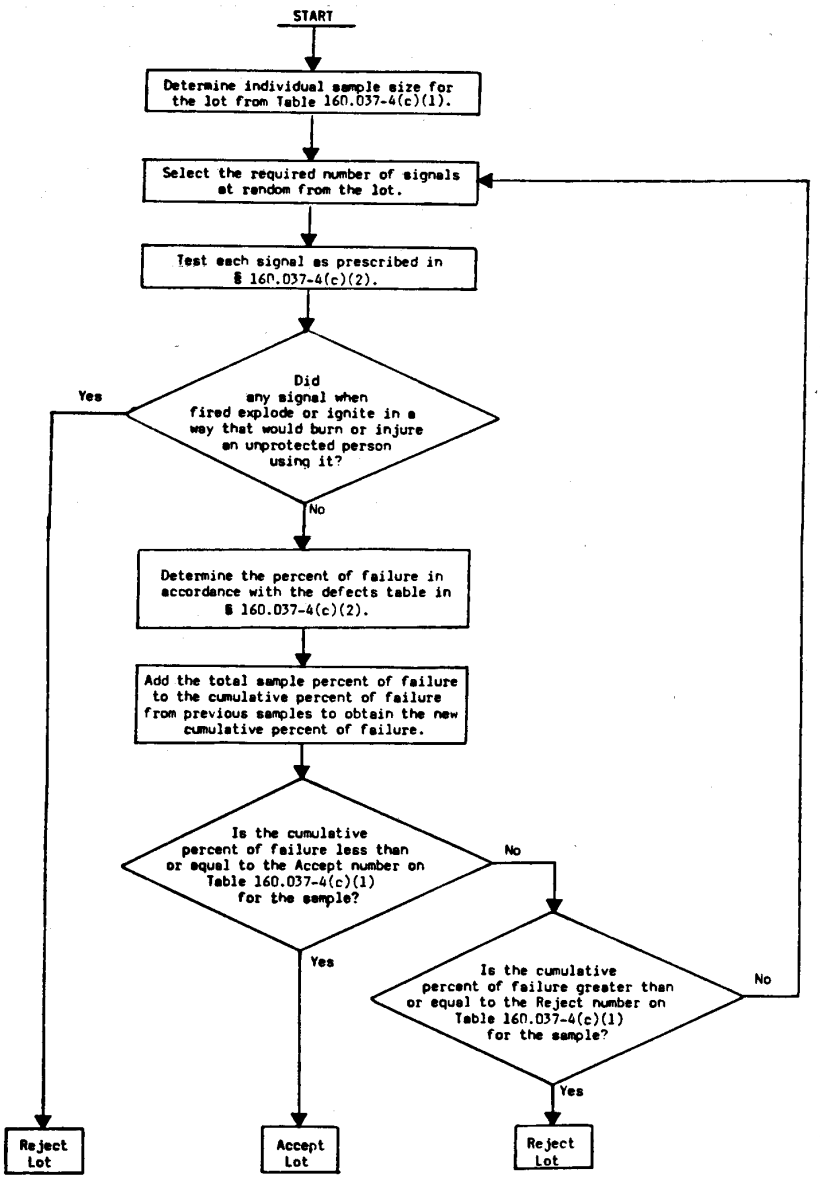

Figure 160.037-4(c). Operational test procedure.

(d) *Technical tests.* Three signals must be subjected to each of the following tests. Two of the three signals must pass each test in order for the lot of signals to be accepted.

(1) *Underwater smoke emission.* Condition each sample in accordance with

paragraph (c)(2)(i) of this section. Ignite specimen and let it burn about 15 seconds in air. Submerge the burning signal in water in a vertical position with head down. Obtain underwater smoke emission time by stop watch measurements from time of submersion until smoke emission ceases. The test specimen shall burn underwater not less than 10 seconds when subjected to this test.

(2) *Bending strength.* Place the specimen on supports 15 cm (6 in.) apart. Attach a weight of 35 kg (77 lb.) to a length of wire. Hang the weight from the supported signal by looping the wire around the signal approximately equidistant from the two points of support. Let the weight hang approximately 5 minutes. The test specimen shall not deflect more than 7 mm (¼ in.), nor shall the joint between the casing and the handle fail when subjected to this test.

(3) *Tensile strength.* Place the specimen in a chuck firmly holding it about 13 mm (½ in.) below the cap. Attach a weight of 35 kg (77 lb.) to a length of wire. Hang the weight from the supported signal by looping the wire through a hole bored perpendicular to and through the axis of the handle. Let the weight hang approximately 5 minutes. The test specimen shall not show noticeable distortion, nor shall the joint between the casing and handle fail, when subjected to this test.

(4) *Elevated temperature, humidity and storage.* Place specimen in a thermostatically controlled even-temperature oven held at 75 °C. with not less than 90 percent relative humidity for 72 hours. Remove specimen and store at room temperature (20° to 25 °C.) with approximately 65 percent relative humidity for 10 days. If for any reason it is not possible to operate the oven continuously for the 72-hour period, it may be operated at the required temperature and humidity for 8 hours out of each 24 during the 72-hour conditioning period. (Total of 24 hours on and 48 hours off.) The signal shall not ignite or decompose during this conditioning. The signal shall ignite and operate satisfactorily following this conditioning.

(5) *Spontaneous ignition.* Place the specimen in a thermostatically controlled even-temperature oven held at 75 °C. with not more than 10% relative humidity for 48 consecutive hours. The signal shall not ignite or undergo marked decomposition.

(6) *Susceptibility to explosion.* Remove smoke composition from signal and punch a small hole in the composition. Insert a No. 6 commercial blasting cap. Ignite the cap. The test specimen shall not explode or ignite.

(7) *Color of smoke.* Ignite specimen in the open air in daytime according to the directions printed on the signal, and determine the smoke color by direct visual comparison of the unshadowed portions of the smoke with a color chart held so as to receive the same daylight illumination as the unshadowed portions of the smoke. The color of the smoke must be orange as defined by Sections 13 and 14 of the ''Color Names Dictionary'' (colors 34–39 and 48–54).

(8) *Volume and density of smoke.* The test specimen shall show less than 70 percent transmission for not less than 30 seconds when measured with apparatus having a light path of 19 cm (7½ in.), an optical system aperture of +3.7 degrees, and an entrance air flow of 18.4m^3 per minute (650 cu. ft. per minute), such apparatus to be as described in National Bureau of Standards Report No. 4792.

§ 160.037–5 Labeling and marking.

(a) *Labeling.* Each hand orange smoke distress signal shall bear a label securely affixed thereto, showing in clear, indelible black lettering on an orange background, the following wording and information:

(Company brand or style designation)

HAND ORANGE SMOKE DISTRESS SIGNAL

For daytime use—50 seconds burning time

USE ONLY WHEN AIRCRAFT OR VESSEL IS SIGHTED

DIRECTIONS: Pull tape over top of cap. Remove cap and ignite flare by rubbing scratch surface on top of cap sharply across igniter button on head of signal.

CAUTION: Stand with back to wind and point away from body when igniting or signal is burning.